
DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which an invention belongs] This invention is a crosslinked polyethylene insulation power cable (CV cable), for example. In the manufacturing process of an extrusion mold type terminal area and a block mold form terminal area, it is related with whether the foreign matter used as a defect exists in this resin Nakauchi, and the method of inspecting directly at the time of resin insulator pouring.
[0002]
[Background of the Invention]In formation of the block mold insulator used for formation of the extrusion mold terminal area (EMJ) of a CV cable, or a block mold type terminal area (BMJ), the method which pours in the resin insulator of a molten state from an extrusion machine to a metallic mold is adopted. Here, since the electrical property of EMJ or BMJ is greatly influenced by mixing of the foreign matter to the inside of an insulator, the product tampering inspection in a resin injection time is very important.
[0003]Although the inspection by roentgenography has generally so far been adopted as such a dust-particle-inspection method, for example, it does not respond to X-rays, by this method, foreign matters, such as cotton textiles, have the fault of being undetectable. Then, methods adopted in recent years include a laser beam method and a CCD camera method. These methods are the methods of inspecting directly the whole quantity of the resin which provides the transparent area using polyethylene resin and the glass window of the resin supply line transparent, for example to a part from an extrusion machine, and is poured into a metallic mold in the transparent area.
[0004]A laser beam method irradiates with a laser beam the resin flow which should be inspected, and the size of a foreign matter is computed by regarding as an image the shadow which the foreign matter interrupted. As specifically shown in drawing 1, it irradiates with a laser beam with the laser floodlight 11 from the transparent outside-surface side of the glass tube 2 through which the resin P is flowing. That is, it glares so that the light from the laser oscillator 111 which generates the laser beam of a single wavelength may be scanned to the diameter direction of the glass tube 2 in the state where it was extracted to the narrow beam using the polygon mirror 112. On the other hand, this laser beam is received by the electric eye 12 which has the photo-multiplier 121 in the opposite hand of the glass tube 2. And when the resin P has flowed including

the foreign matter C, the knowledge of the size of the foreign matter C is carried out by making the shadow which this foreign matter C interrupts scan for every time, namely, detecting existence of a foreign matter as change of the light income for every scanning line, and making and processing a screen based on this.
[0005]Here, the light which passes the glass tube 2 does not have refraction because of the laser beam of a single wavelength, and the image of the foreign matter C is not expanded by a lens effect. However, the resin P which flows through the inside of the glass tube 2 has the late whole not uniform velocity but near the tube wall, and becomes early in the center. Therefore, although the knowledge of the size can be correctly carried out when the image which placed the standard of the rate of flow of the resin P in the center of a pipe, and caught it is analyzed, and the foreign matter C passes through near the center of the glass tube 2, when it passes through near a tube wall, there is inconvenience of recognizing the shape of a foreign matter in the state where it changed long and slender.
[0006]A CCD camera method picturizes with a camera the resin flow which should be inspected, carries out image processing of the image taken in from this camera, analyzes it, and detects the size and color of a foreign matter. As specifically shown in drawing 2, picturize the transparent glass tube 2 with which the resin P is flowing with CCD camera 13 from that outside-surface side, and this image is recorded by VTR14, and it is processing with the image processing device 15, and the knowledge of the size of the foreign matter C and the color is carried out.
[0007]However, as for this CCD camera method, processing time starts for a long time, while processing, the next screen cannot be processed, but continuous processing is impossible in real time. Then, it once records on VTR14 and the two-step method of carrying out image processing if needed must be taken. Since the glass tube 2 is photoed from the outside, and the foreign matter C is expanded by the lens effect of the glass tube 2 and it is picturized, there is a problem that amendment of a picture is needed.
[0008]This invention solves an above-mentioned problem, and can carry out the knowledge of the size of the foreign matter contained in the resin which circulates the inside of a pipe correctly, and it aims at providing the dust-particle-inspection method that the classification of a foreign matter can also be further presumed based on the color.
[0009]
[Means for Solving the Problem]A dust-particle-inspection method in pouring resin of this invention provides a part for a transparent tube part in a supply line of resin which should be poured into a prescribed spot, An optical measurement means which scans a 1 section part of said transparent pipe optically to the upstream of resin flow, and recognizes passage of a foreign matter, When an imaging means which picturizes said transparent pipe from the side is provided in the downstream, respectively and said optical measurement means has recognized passage of a foreign matter, a picture which operates said imaging means and contains said foreign matter is acquired.
[0010]A dust-particle-inspection method in pouring resin of everything but this invention, An optical measurement means which provides a part for a transparent tube part in a supply line of resin which should be poured into a prescribed spot, scans a 1 section part of said transparent pipe optically to the upstream of resin flow, and recognizes a two-dimensional size of a foreign matter from passage of a foreign matter and the amount of protection from light, An imaging means which picturizes said

transparent pipe from the side is provided in the downstream, respectively, It asks for three-dimensional shape of a foreign matter from two-dimensional information on a foreign matter which acquired a picture which operates said imaging means and contains said foreign matter when said optical measurement means had recognized passage of a foreign matter, and was obtained from the above-mentioned optical measurement means, and said picture information.

[0011]It is preferred to constitute based on the above-mentioned picture information, so that a color of a foreign matter may be searched for.

[0012]

[Embodiment of the Invention]Hereafter, based on a drawing, it explains per embodiment of this invention. Both fault is compensated with making an above-mentioned laser beam method and CCD camera method link organically, and the method of this invention enables it to analyze a foreign matter highly efficiently more according to it for a short time.

[0013]Drawing 3 shows the example which applied this invention to the injection molding of the block mold insulator used for a block mold type terminal area (BMJ). the core 31 of the couple which imitates the cable which 3 is an extrusion mold and should connect with the inside in a figure and by which penciling processing of the tip was carried out -- 32 countering mutually and, The spindle-shaped cavity 30 is formed in the inner surface of the metallic mold 3 by the high voltage shield electrode 33 which consists of a metal cylinder-like object on this opposite portion being arranged. It is applicable similarly only by replacing the core 31 and a cable with actual 32 also in an extrusion mold terminal area's (EMJ) case.

[0014]Insulating resin, such as polyethylene made into the molten state, is injected into the cavity 30 of the above-mentioned extrusion mold 3 via the pipeline 20 from the extrusion machine 4. Transparent pipe 2 portion is provided in the middle of this pipeline 20, and it enables it to observe said pouring resin from the outside. Although a glass tube is preferred as this transparent pipe 2, it may be a heat-resistant transparent resin pipe etc.

[0015]And in transparent pipe 2 portion, the optical measurement means which consists of the laser floodlight 11 and the electric eye 12 is established so that the upstream of resin flow may be countered on both sides of the transparent pipe 2, and on the other hand, it is arranged at the downstream of resin flow so that CCD camera 13 as an imaging means may picturize the transparent pipe 2 from the side. S is the lighting for CCD camera 13. If it changes a locating position and it is arranged two sets or more, since this CCD camera becomes easy to catch the three-dimensional shape of a foreign matter, it is preferred.

[0016]From the laser floodlight 11, a laser beam is irradiated here so that the 1 section part of the transparent pipe 2 may be scanned optically, as drawing 1 explained. And light is received by the electric eye 12, when the foreign matter is mixing into resin, a laser beam will be shaded with this foreign matter, and change will produce the light which penetrated the transparent pipe 2 in the light-receiving characteristic. This light-receiving signal is transmitted to the processing unit 5, it recognizes here that the foreign matter existed first from change of said light-receiving characteristic of protection from light, i.e., the amount by passage of a foreign matter, and the processing which presumes the two-dimensional size of a foreign matter further is made.

[0017]VTR14 and the image processing device 15 which record a taken image are connected to said CCD camera 13, and the imaging means is constituted in it as drawing 2 explained. This imaging means is constituted so that it may operate with the foreign matter recognition signal sent out from the above-mentioned processing unit 5. That is, when the processing unit 5 of an optical measurement means has recognized passage of a foreign matter, the image of CCD camera 13 currently installed downstream from resin flow is captured into the image processing device 15, and the picture which contains said foreign matter by this is acquired efficiently. Thus, the acquired picture is processed with the image processing device 15, and the three-dimensional shape of a foreign matter is called for from the two-dimensional information on the foreign matter further obtained from the above-mentioned optical measurement means, and the picture information concerned. Always recording a picture by VTR14, it is usually constituted so that an image may be captured into the image processing device 15, only when a foreign matter passing signal is converted.

[0018]Here, the above-mentioned optical measurement means may be made into the role of only detection of the existence of foreign matter passage, and it may constitute so that the image which operates an imaging means based on this foreign matter passing signal, and contains a foreign matter can be captured. In this case, if two or more sets are arranged so that the corporal vision of CCD camera 13 can be carried out, the knowledge of the suitable three-dimensional shape of a foreign matter can be carried out.

[0019]Although the above is an outline of this invention, lessons is taken from a foreign-matter-detection principle etc. below, and it explains in full detail further. Drawing 4 is an explanatory view showing the foreign matter measuring situation by the optical measurement means which consists of the laser floodlight 11 and the electric eye 12. the time of the casting resin (the polyethylene used widely by BMJ etc. is usually transparent) which circulates in the transparent pipe 2 flowing through the inside of a cylindrical pipe -- the central part -- early (the length of an arrow is speed) a flow -- compared with this, near a tube wall has the characteristic of flowing late. Therefore, when the foreign matter of identical shape exists in the central part [of the transparent pipe 2], and tube wall side, naturally, the tube wall side foreign matter will be late, the distance between foreign matters will be opened with time, and it will go.

[0020]In this situation, a laser beam (beam) is made to scan horizontally for every fixed time by the 1 section part of the transparent pipe 2 with the laser floodlight 11, and if the signal which interrupts a beam of light with a foreign matter is detected by the electric eye 12 when passing through the inside of the transparent pipe 2, a foreign-matter-detection signal which is illustrated will be acquired. And when this signal is compounded and processed, and was displayed and it asks for the size of a foreign matter on the basis of the resin rate of flow in transparent pipe 2 center section, Although it is detectable to abbreviated accuracy, since the tube wall side foreign matter c2 has much number of times which interrupts a laser beam beam, the near [a center section] foreign matter c1 of a pipe will be detected long and slender perpendicularly. Although there is also a method of carrying out the simulation of this about resin in the transparent pipe 2 flowing, and performing block correction, the flow of resin in a pipe is not simple and is difficult.

[0021]Thus, grasping the three-dimensional shape of a foreign matter correctly is accompanied by difficulty only by the optical measurement means which consists of the

laser floodlight 11 and the electric eye 12. However, the two-dimensional shape d1 and d2 can grasp the near [a center section] foreign matter c1, and the tube wall side foreign matter c2 to abbreviated accuracy at least. That is, it is detectable whether the cross section size d1 of how much and the foreign matter which has d2 passed through the 1 section part of the transparent pipe 2.

[0022]On the other hand, when it picturizes with CCD camera 13 as stated above, an image will be expanded oblong by the lens effect of the transparent pipe 2. However, unlike the case where resin flow is foreseen, it is possible to ask for the partial magnifying power by a lens effect beforehand, and there is an advantage which is easy to amend.

[0023]Then, when the optical measurement means arranged at the upstream has recognized that there is a foreign matter which should be made applicable to detection, CCD camera 13 is operated and is incorporated as a picture. The first signal that caught existence of a foreign matter by the optical measurement means is specifically used as an image taking signal of an imaging means, a picture is put into the image processing device 15 with CCD camera 13, and computation is performed. Based on the flow of resin, after the foreign-matter-detection signal by an optical measurement means arrives, timing of this image taking is carried out, and it is performed until a foreign matter exists in the view of CCD camera 13. It is preferred that another signal makes it it seem that it may enter as [process / into the image processing device 15, it equips with the memory of required image taking beforehand, and / it / at any time] in the midst of calculating.

[0024]The picture seen from the side of the transparent pipe 2 of the foreign matter contained in resin flow by this will be acquired. The size and shape (side direction two-dimensional shape) which were seen from the side of an exact foreign matter when considering and calculating the correction value in each portion of the picture searched for beforehand and computing that true value since the foreign matter in this picture was expanded by the lens effect of the transparent pipe 2 It can deduce.

[0025]And two-dimensional shape (cross sectioned direction two-dimensional shape) of the foreign matter obtained by the aforementioned optical measurement means It can ask for the three-dimensional shape of a foreign matter by performing data processing from the related information and the information about the side direction two-dimensional shape based on this picture information. Here, foreign matter information including distortion resulting from the resin flow speed difference within [which was detected by the optical measurement means] transparent is corrected by making it compare with picture information. The history of a foreign matter can also perform that presumption which is what by the sexual desire news contained in picture information. The size of a foreign matter, shape, a color, etc. can detect very promptly by controlling image processing to necessary minimum by this method compared with the conventional system which was always performing image processing.

[0026]By the way, although CCD camera 13 is arranged at the upstream of resin flow [in / in the laser floodlight 11 / the transparent pipe 2] at the downstream as above-mentioned, when the laser beam by the laser floodlight 11 enters into CCD camera 13, a taken image may be influenced by the color by a laser beam. Therefore, it is necessary to consider that the laser floodlight 11 and CCD camera 13 can incorporate the color of the foreign matter itself by opening and arranging an interval enough or forming a shading device among both so that such influence may not reach.

[0027]Although the case where this invention was applied to the terminal area of CV cables, such as EMJ and BMJ, above was explained, In addition, for example, it is suitably [for manufacture of various products in which an advanced quality control is demanded by the casting using transparent resin, such as a supply line of insulating-layer resin in a cable manufacturing installation, and a resin supply line in the molding equipment of a general resin casting object,] applicable.
[0028]
[Effect of the Invention]According to the dust-particle-inspection method in pouring resin of this invention as explained above, by using together the test equipment by laser, and the device using a CCD camera. The height detection sensitivity and high speed processing capability which a laser beam method has, and the discernment capability of the foreign matter which a CCD camera method has can be harnessed simultaneously. That is, since it was made to perform the CCD camera method which can detect exact foreign matter information only when a laser beam method detected existence of a foreign matter although analysis took time comparatively, a substance can be presumed from the size of a foreign matter, a color, and a form very efficiently and promptly, and a harmful foreign matter can be judged.
[0029]When this applies this invention to pouring of the resin insulator to the metallic mold in formation of the block mold insulator used for formation and BMJ of EMJ of a CV cable, for example, Since a foreign matter is judged promptly and the quality quality of the resin poured in can be determined at an early stage, the outstanding effect that the material losses by a failure and the futility of working hours can be excluded is done so.

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]An optical measurement means which provides a part for a transparent tube part in a supply line of resin which should be poured into a prescribed spot, scans a 1 section part of said transparent pipe optically to the upstream of resin flow, and recognizes passage of a foreign matter, A dust-particle-inspection method in pouring resin acquiring

a picture which operates said imaging means and contains said foreign matter when an imaging means which picturizes said transparent pipe from the side is provided in the downstream, respectively and said optical measurement means has recognized passage of a foreign matter.

[Claim 2]An optical measurement means which provides a part for a transparent tube part in a supply line of resin which should be poured into a prescribed spot, scans a 1 section part of said transparent pipe optically to the upstream of resin flow, and recognizes a two-dimensional size of a foreign matter from passage of a foreign matter and the amount of protection from light, An imaging means which picturizes said transparent pipe from the side is provided in the downstream, respectively, A dust-particle-inspection method in pouring resin asking for three-dimensional shape of a foreign matter from two-dimensional information on a foreign matter which acquired a picture which operates said imaging means and contains said foreign matter when said optical measurement means had recognized passage of a foreign matter, and was obtained from the above-mentioned optical measurement means, and said picture information.

[Claim 3]claim 1 characterized by searching for a color of a foreign matter further based on picture information, or 2 -- a dust-particle-inspection method in pouring resin given in either.

[Translation done.]